


Review

A Review on Significant Factors Causing Delays in Saudi Arabia Construction Projects

Abdulali Mohammed Alajmi and Zubair Ahmed Memon * 

College of Engineering, Prince Sultan University, Riyadh 11586, Saudi Arabia

* Correspondence: zamemon@psu.edu.sa

Abstract: The Kingdom of Saudi Arabia (KSA) is suffering major delays in construction projects. Because the construction business in Saudi Arabia has changed dramatically over the last three decades, it is crucial to conduct a thorough study into the reasons for delays and to get industry experts on the same page. In this paper, an overview of the construction sector generally and the Saudi Arabian construction industry has been presented. Based on the literature review the major causes, as well as effects of the delays caused in the construction industry, have been identified. Some of the common causes identified are incorrect planning, administration problems, difficulties in financing, lack of experienced staff, and poor communication. It is advised that the major actors in the construction sector employ the proper tactics to implement preventative measures to lessen the consequences when carrying out construction projects.

Keywords: construction industry; delays; Saudi Arabia; cause; effect



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1. Introduction

Despite the continual rise of mega projects executed throughout the world, the construction sector has been trailing behind other sectors such as aerospace, automotive, and shipbuilding for more than four decades. There are several reasons for productivity forfeiture in building projects. The occurrence of delays is one common source of productivity losses in the construction industry. A delay can be described as a circumstance in which the completion date of a project is pushed back because of factors such as the client, consultant, contractor, and others. Delays may also be defined as circumstances in which an event occurs later than anticipated, is completed later than intended; when prompt action is not done, or when an occurrence takes place after the date specified in the contract [1].

Construction projects are unique enterprises with a variety of distinctive traits, including a lengthy timeline, a hostile atmosphere, challenging methods, and significant financial risk. Extreme hazards result from such organizational and technological complexity, which have resulted in construction project delays and cost overruns [2]. Construction delays can be defined as the additional time required or incurred beyond the scheduled completion date or beyond the date that the project stakeholders agreed upon for project completion. The efficiency of all project participants is measured by their capacity to execute the project on time, but the building process is subject to several factors and unforeseen events that might emerge from a range of sources [3].

Delay is frequently caused by an occurrence that must be controlled through an effective strategy to reduce its effects. Systematic delay management ensures that the source of the delay is recognized and documented as soon as feasible throughout building projects. Delays in building projects can occur for a variety of reasons. The components rely on innovation and its management, as well as those from the physical, social, and financial environments [4]. Delays in construction projects are typically expensive. This is because there is an interest-bearing construction loan, managerial staff who are time-dependently paid for the project, and ongoing wage and material price inflation. Construction delays

could result in the project being completely shelved. The owner as well as the contractor suffer from delays. For the owner, delays result in a loss of possible income from the usage of project deliverables, as well as an increase in project management and contract supervision overhead costs. Due to increased material, labor, and overhead costs, delays cause the contractor to incur additional expenses. Construction projects are delayed due to various circumstances arising from various sources. The performance of stakeholders, contractual relationships, and the project domain are examples of these sources [5]. For the success of any construction company, it is critical to pinpoint the main reasons for delays as well as their effects.

The first step to fight and solve any problem is to identify and note down the problem. Additionally, it is equally important to understand the consequences of the problem and point out the most serious ones of those. Therefore, the main aim of this research is to identify the factors that are mostly responsible for causing delays in the construction industry and highlight the major effects of delays in the industry. For this purpose, this study sought to introduce and give a detailed overview of the construction sector in Section 2. This section includes a description of the types of construction companies and has a subsection dedicated to the construction companies in Saudi Arabia specifically. The next section provides a detailed discussion about the delays in construction companies across the world and delays in construction companies in Saudi Arabia specifically. After providing a detailed introduction to the construction companies, a literature review carried out for the identification of causes and effects of delays has been presented in Section 4. Previously published work was chosen from databases such as Scopus and Web of Science. Recent work from the past four to five years has been given more importance; however, several articles that were not as recent have also been mentioned owing to the importance of their research findings and methodology used. Almost all the previous work mentioned has been published in reputed journals with a few exceptions from conference proceedings. While searching for related papers, keywords such as delays, cost overruns, causes and effects, and construction were used. Although a lot of work has been published in this field, the list was narrowed down based on the number of citations each paper had received, with priority given to highly cited papers. The impact factor of the journal the work was published in was also considered as a factor while choosing the papers. Moreover, it has been tried to always prioritize recent research. After narrowing down the list of previously published work in this field, a detailed study of the literature was completed, and causes identified were noted. Finally, the most frequent causes that were stated as a matter of concern in most of the previous research were identified. The results obtained in the form of the most frequent causes and effects of delays is presented in Section 5. Finally, a discussion is provided, and a conclusion is drawn.

2. Construction Companies and Its Types

A nation's economic development is greatly influenced by the vital industry of construction. The government is particularly interested in the investment-driven business of construction. Building infrastructure for the health, transportation, and educational sectors is a joint effort between the government and the construction industry. A particular kind of business, firm, enterprise, or comparable organization was established to build different structures, developments, properties, facilities, dwellings, paths, pavement, roads, motorways, and other construction projects. Construction companies carry out infrastructure and building projects. They construct whatever is on the drawing sheets for a fee decided upon before their clients, turning it into reality. The building industry is a sizable multitasking organization rather than a solitary entity that carries out a single duty. Construction is entwined with civil engineering and architecture. An owner, a qualified designer (architect or engineer), and a builder (Contractor) are the three main players in the construction industry. When these parties collaborate to plan, develop, and construct a project, they typically sign two contracts. In general, there are four sorts of building projects to be completed and those are:

- Residential Building;
- Institutional and Commercial Building;
- Specialized Industrial Construction;
- Infrastructure and Heavy Construction.

A construction company oversees construction structures in both the public and private sectors. Construction companies are categorized as follows.

2.1. Civil Engineering Companies

A civil engineering firm created the structural components, including the base, structural steel, and concrete workstations. A construction company also builds the building that the civil engineers have designed. A civil engineering company would typically only offer engineering and surveying services [6]. Civil engineering firms may also design roads and bridges in addition to planning and outlining the scope of projects. Civil engineering firms are involved in the design, construction, and maintenance of the built environment, including roads, bridges, canals, dams, airports, sewage systems, pipelines, structural components of buildings, and trains.

2.2. Construction Contracting Company

A general contractor usually referred to as the main contractor or prime contractor, is in charge of managing vendors and tradespeople, keeping everyone informed about a construction project as it progresses, and supervising a building site on a daily basis. A general contractor is responsible for providing all supplies for the project's construction, including labor, supplies, tools (such as engineering trucks and equipment), and services. Specialized subcontractors are regularly used by general contractors to finish all or parts of a building project.

2.3. Heavy Engineering and Construction

Roads (highways, streets), dams, bridges, utility lines, and other heavy and civil engineering projects, such as land subdivisions, are all built by companies in this field.

2.4. Industrial Infrastructure Company

The term "industrial infrastructure" refers to any location, structure, building, industrial park, water dock, pier, or port facilities, fixtures, machinery, equipment, and related facility, including real and personal property, suitable as a factory, mill, or shop, or processing, assembly, manufacturing, or fabricating project, etc. Industrial construction, often known as industrial infrastructure, is a type of construction that necessitates specialized training and multi-tasking professionals. A slew of managers, engineers, and architects oversee projects. Many industrial construction corporations are multi-national conglomerates.

2.5. EPC—Engineering, Procurement and Construction Company

EPC stands for Engineering, Procurement, and Construction, and it is the most customary type of construction contract. These engineering and construction companies will finish the project's comprehensive engineering design, obtain all necessary tools and materials, and then build to give their clients a functional building or asset [7]. EPC Contractors or EPC Companies are terms used to describe companies that provide EPC Projects.

2.6. PMC—Project Management Consultant

PMC, which stands for a project management contract, is an abbreviation. An engineering contractor will supervise the EPC Contractors' work under a project management contract to verify that it adheres to the client's work scope. At various stages, project management consultants use their knowledge, skills, and experience to manage the project.

2.7. Real Estate Companies

Immovable property of this type; an interest vested in this an item of real property, buildings, or habitation in general; property consisting of land and the buildings on it, as well as its natural resources such as crops, minerals, or water; an interest vested in this an item of real property, buildings, or housing in general [8]. Real estate includes things such as land, buildings, air rights above the earth, and subsurface rights below the earth. The term “real estate” refers to physical or tangible property. The word “real” derives from the Latin root *res*, which means “things.” Only real estate owners were first granted voting privileges under the United States Constitution.

2.8. MEP—Mechanical, Electrical, and Plumbing Contractors

The goal of mechanical, electrical, and plumbing (MEP) engineering is to create a safe environment for humans to use. An MEP consulting firm is just as important for any construction or remodelling project as an architect or builder. An engineering company that specialized in MEP, such as an MEP consultant or MEP contractor, usually develops mechanical, electrical, and plumbing components.

2.9. Small Renovation Contractors

Small renovation contractors are those who offer pre-planned renovations to buildings, homes, businesses, and other business initiatives. A contractor that works on projects requiring the planned renovation of a small space, such as an office, a building, or a place of business, is known as a “small renovation contractor”.

3. Construction Companies of Saudi Arabia

The KSA works to address problems such as poverty, inequality, climate change, prosperity, peace, justice, education, health, social protection, and the accessibility of employment opportunities. Recognizing the interconnectedness of these problems, the KSA makes sure that each one is addressed in its national strategy [9]. The success of Vision 2030 projects to meet the following Five Goals as outlined in Figure 1 will depend in large part on construction enterprises.

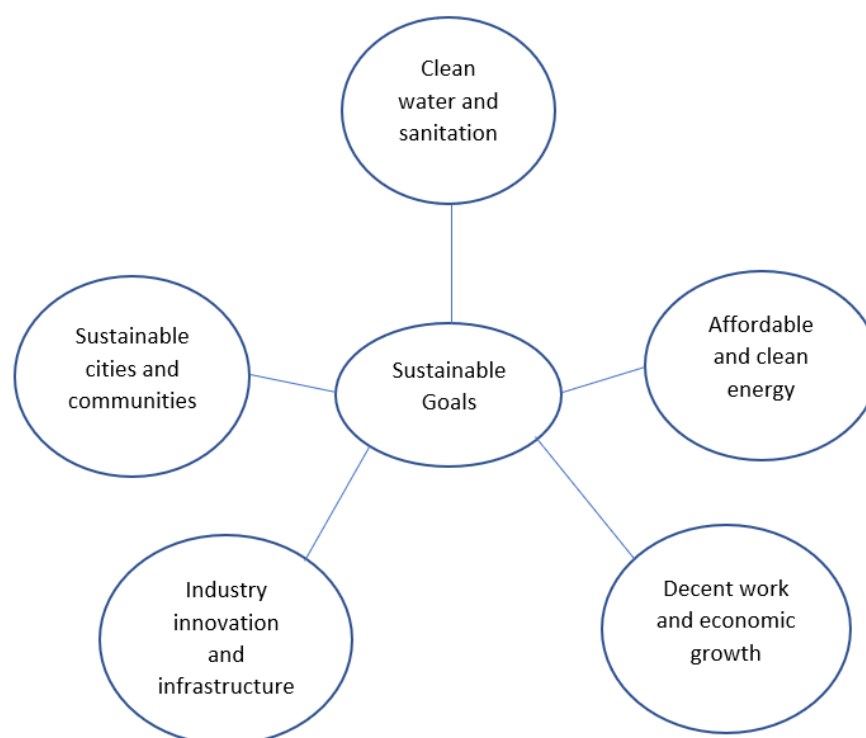


Figure 1. Vision 2030 projects Goals.

Construction enterprises will contribute to the achievement of sustainable development goals by completing associated small and big projects. Successful execution of these initiatives will result in strong organizations and economies, which will help cities and communities grow [9].

The construction sector in Saudi Arabia is experiencing rapid growth as a result of the increasing demand for Vision 2030 projects, particularly mega-projects. In the last two decades, Saudi Arabia has encountered an unparalleled construction boom, with the country's infrastructure quickly expanding (such as the development of new cities, airports, public and private buildings, highways, and other infrastructure), luring construction experts from all over the world. The construction sector in Saudi Arabia rose in perfect agreement with the country's flourishing economy, which was supported by large oil earnings. Even though the Saudi construction sector has faced major challenges as a result of political concerns and false information, the previous two decades have been marked by a shift in the social, economic, political, and security circumstances, as well as escalated oil prices. As a result, plenty of large-scale development projects have contributed to expanding the country's fundamental infrastructure. Highways, roads, dams, water collecting and distribution systems, and housing constructions are among the projects. One of the most significant issues in these projects is the recurrent and protracted delays, for which the Saudi construction sector is unprepared. To establish sufficient reaction plans, it is critical to recognize the underlying reasons for such delays [10].

The construction sector is a key altruist to wealth creation and employment in the KSA's economy. This industry provides to the demand for new facilities, infrastructure, and buildings, among other things. In the following years, the Saudi Arabian government's increased focus on expanding net expenditure and the introduction of Vision 2030 is projected to considerably enhance the country's economy and construction sector. As seen in Table 1, Saudi Arabia accounts for about 43 per cent of all building projects in the GCC, the biggest number of projects, followed by the UAE (29 per cent) [11]. The construction business is diverse and interconnected with numerous areas of the economy, as seen in our contemporary reality [12]. To conclude, according to The Arab World Competitiveness Report, the Saudi Arabian economy is the most cutthroat in the Arab world, particularly among Middle Eastern and Gulf States countries. Enormous mega-projects have been launched as a result of this strong and constant expansion.

Table 1. Percentage of construction projects [12].

GCC Countries	Construction Projects (%)
Saudi Arabia	43
United Arab Emirates	29
Qatar	11
Kuwait	8
Oman	6
Bahrain	3

4. Delays in Construction Companies

This section provides an overview of the delays in construction companies across the globe and especially in Saudi Arabia.

4.1. Delays in Construction Companies across the World

Reviews from other countries serve as a broader overview of the topic of construction delay. For this reason, it is considered equally important to study the previous work in this field published in countries other than Saudi Arabia. In this section, important recently published work about delays in other countries has been explained briefly. Critical and non-critical project delays, as well as coincident, remunerative, and forgivable delays, are

the five most prevalent types of project delays discussed in the literature [13]. A critical route activity's advancement and how it influences (or does not influence) the project completion date is referred to as critical and non-critical delays. Concurrent delays occur when at least two independent delays take place at the same time. Unanticipated delays are those that happen for reasons outside the contractor's control and are payable and/or morally acceptable. All of these sorts of delays have an impact on project management. External delays are given rise to by third parties engaging in the project delivery process, whereas internal delays are caused by project stakeholders (i.e., utility service providers, government authorities, labor unions, etc.) [14].

Aspects that were relevant to the project, the client, the design team, the contractor, supplies, labor, plant and equipment, and external factors were all investigated in [15] by Chan and Kumaraswamy. In [16], the relative importance of delay factors in Hong Kong was found. Inadequate risk management, poor supervision, unanticipated site circumstances, sluggish decision-making involving variation, and essential variation works were identified as the five main causes of delay. The trend of project delays and cost overruns in India starting in 2001 is shown in [17]. It can be seen in Figure 2 that the trend of delays in India during the past 15 years has not changed.

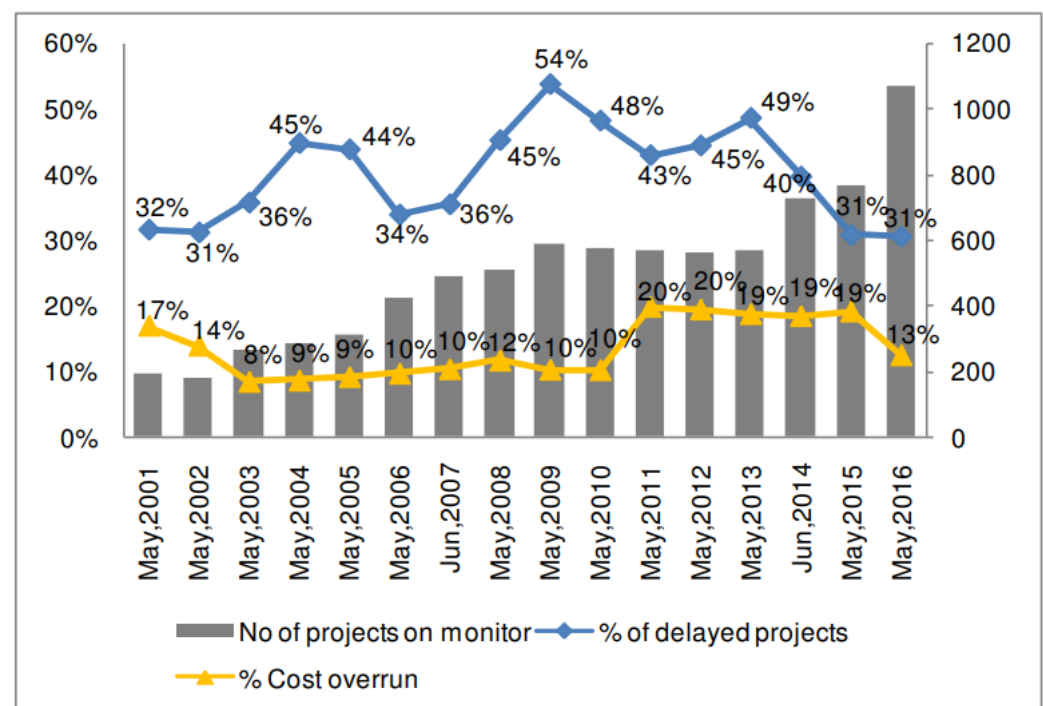


Figure 2. Delay and cost overrun trends in India over the past 15 years [17].

Odeyinka and Yusif [18] examined Nigeria, the reasons for housing project delays, and found three primary categories: client-, consultant-, and contractor-caused delays, as well as extraneous variables. Client-induced delays, according to the study, are mostly caused by project design variance. Client-induced delays, according to the study, are mostly caused by project design variance. Mansfield et al. [19] examined the reasons for delays and cost overruns, and it was discovered that the respondents had a high level of agreement on the elements that may cause delays and cost overruns. The finance and payment for finished works, inadequate contract management, changes in site circumstances, and material shortages were the four most critical problems agreed on by the contractor, consultants, and public customers questioned [20].

In Ref. [21], the 73 causes of delays in large construction projects in Saudi Arabia were stated and recognized. They looked at the relevance of various delays from the perspectives of contractors, consultants, and owners. Change orders from the owner, delays in progress

payments, inefficient planning and scheduling by the contractor, labor shortages, and contractor financial challenges were the main reasons for the delay. Change orders, according to all stakeholders, were the most prevalent source of delays. According to the authors, almost 70% of the projects had time overruns. The study was conducted by Kaliba et al. [22]. Road development projects in Zambia were delayed due to a variety of factors. The first reason for timetable delays was discovered to be late payments, followed by financial challenges, materials procurement, changes in designs, and personnel issues. Unfavourable weather caused by severe rainfall was also indicated as a significant danger. The study's suggestions included careful and timely planning so that the majority of the work could be completed during pleasant weather seasons [10]. To get the opinions of 148 Malaysian construction professionals from client, consultant, and contractor organizations, a field survey was used in [23].

System dynamics are vital in determining the influence of important project staff changes on design production in building projects [24]. As a consequence, defining the most significant reasons for the delay is condemnatory to minimize or lessen their influence on building projects. A comprehensive questionnaire was created and utilized to get feedback from UAE construction industry specialists [25]. Using a collection of 45 qualities, this study first recognized the main variables affecting delay in the Indian construction sector and then put in place the link between the crucial attributes to produce prediction models for analyzing these aspects' effects on delay [20]. Time Extension Factors in the Construction Industry of Pakistan are discussed in [26]. To identify the reasons for construction delays in Algeria and rate their relevance according to the primary project stakeholders, which are the owner, contractor, and consultant. Data was gathered through a questionnaire and in-person interviews with a sample of construction specialists, comprising 16 owners, 16 contractors, and 20 consultants. In this study, fifty-nine reasons for the delay were discovered [10]. Important reasons for time overruns in Indian building projects and mitigating actions were recognized in [27]. The criticality of construction industry problems in developing countries was studied, analyzing Malaysian projects [28]. Questionnaire surveys were conducted to determine and analyze the attitudes of people of the local communities in which the projects were created for two case studies of regeneration initiatives in KSA [29]. The purpose of the study in [30] is to look into the causes and impacts of building project delays in Pakistan. The data is acquired from 37 construction companies, and questionnaires are delivered to 172 professionals, using the empirical technique. To examine the data, several statistical procedures such as multiple regression are used. The results of this study demonstrate that key sources of delay are related and ordered as contractor, client, consultant, material, and equipment, respectively; however, there is no effect of delay on elements such as labor or the general environment. In the end, it is found that construction project delays lead to large project time and cost overruns, project abandonment, and litigation. These factors collectively can endanger undertakings. The purpose of the research in [31] to examine the applicability and impact of various delay factors on construction projects, to pinpoint the culprit, and assess the impact of adopting Building Information Modeling (BIM) on delays.

The project-specific risk component appeared as the most significant risk element, followed by the economic and market-specific risk factor, the firm-specific risk factor, and the political-specific risk factor as the least critical risk factor, according to the existing work [32]. Some studies' major goal is to evolve a simulation-based technique for comprehending the reasons behind and effects of a skilled labour shortage. An integrated system dynamics model was built using a system dynamics methodology to describe the dynamic interrelationships between the causes and consequences of the skilled labor shortage in construction projects [33]. From the literature study, 49 reasons for the delay were identified and characterized through interviews with Moroccan experts [34]. Then, the research proposed was to find and construct the machine learning models that could be used to perform reliable project delay risk analysis utilizing objective data sources [35]. The authors [36] show the simple models for cost overruns and delay in urban construction

projects in Iran. Additionally, the same studies found in Malaysian construction work in which different approaches were used to show the outcome were used [36]. On the other hand, risk variables impacting the key execution activities of road building projects are also examined [37]. The primary reasons for schedule delays and cost overruns in building projects in Oman linked to clients, contractors, and consultants are examined in [38]. A thorough literature research identifies the causes of delays and cost overruns, and a survey of 100 project managers was carried out to ascertain the top reasons among them. The main client and contractor related causes identified for cost overruns can be seen in Figure 3.

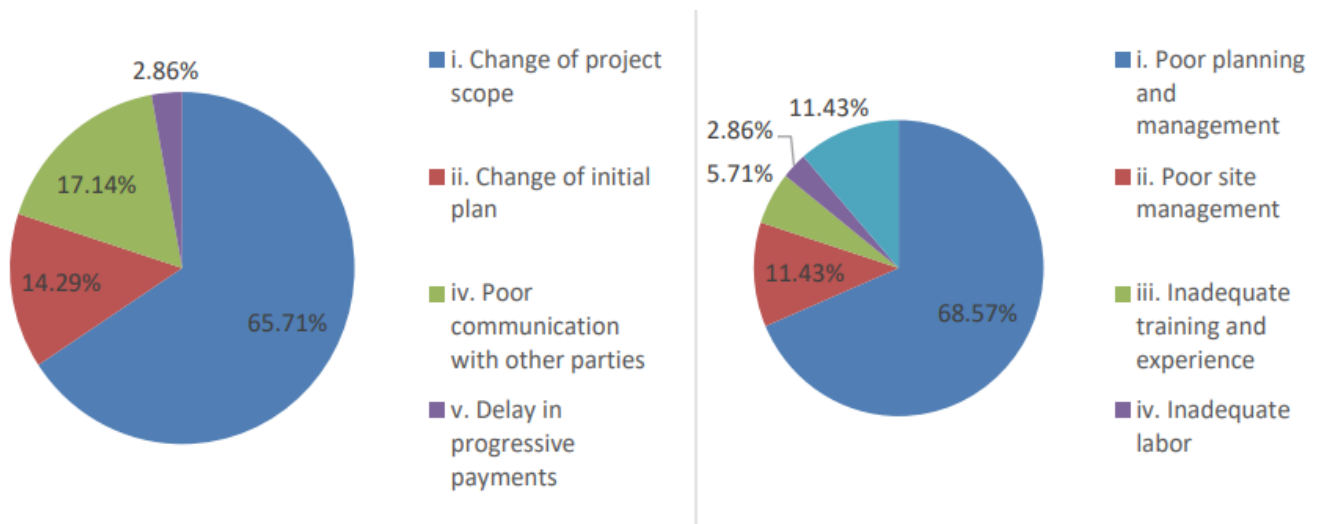


Figure 3. Client- and contractor-related causes for cost overruns [39].

In construction projects, creating management policies and assessing the influence of the change in orders on worker productivity is important [39]. An approach for developing construction project delay mitigation methods is presented. The proposed methodology designing the questionnaire, gathering the data, analyzing the results, and developing delay mitigation strategies in a focus group setting. It is based on determining the root causes of delays and the stages of the construction project where such causes are visible [40]. The key elements that affect building project delays were investigated in [3]. The study is to determine the elements that contribute significantly to cost overruns in Egypt's road network projects throughout the implementation phase. A survey was carried out to establish the most important elements influencing cost overruns in road network development projects [41]. For construction schedule risk analysis, a hybrid machine learning approach was used [42].

In each study, the significance of delay/risk in construction projects for a specific region and country is mentioned. Moreover, Table 2 illustrates the list of studies on delays in construction projects.

Table 2. The magnitude of building project delays as reported by earlier studies [27].

Reference	Country	Type of Project	Finding in the Study
[43]	Turkey	Utility projects	A total of 34.6% delay in contractor's projects, 43.6% delay in projects executed by public agencies.
[44]	Hong Kong	Building and Civil	The average time overrun is more than 20% and only 40% Govt. buildings, 25% private buildings, and 35% civil engineering works completed within schedule.
[45]	UAE	Residential Buildings	Out of 450 buildings, 56% of projects experienced time (2005) overruns, 54% of the projects were delayed by four months or more, and 33% of the projects were delayed by more than six months.
[46]	Malaysia	Government Projects	A total of 17.3% of the projects were delayed by more than three months, abandoned, or otherwise deemed unhealthy.
[47]	Canada	Generic	In some instances, delays went over the initial (1994) contract duration by more than 100%.
[48]	Many Countries	Mixed	The average schedule overrun was 42.7%.
[49]	KSA	Construction mixed	The average project was delayed by 40%.

4.2. Delays in Construction Companies of Saudi Arabia

The causes of delays in the construction sectors of various countries have been discussed previously. The following discussion will now concentrate more on the Saudi Arabian construction sector in particular.

Various studies have been published that attempt to determine the causes of construction delays; however, they all employ different sets of factors. Furthermore, no one has strived to determine the degree to which developments are practicable. A new survey is published that incorporates all the variables from former research and assesses both the existing level of effect on delays and the extent to which each can be improved practically. Seven categories are used to group client, contractor, consultant, materials, labor, contract, and relationship-related reasons. A total of 86 clients, contractors, and consultants from the Saudi construction industry were surveyed. In terms of means and correlations, the study finds significant variation between the cause and respondent groupings, which is likely owing to the respondent's lack of understanding and a propensity for consultants to blame delays on contractors and vice versa. As a result, the primary findings are disunited to reflect the perspectives of each respondent group on each cause group. However, the most affecting current cause of delay is a lack of adequate and skilled staff, which is ascribed to the huge number of major, creative building projects and the resulting present manpower shortage in the industry [50].

The goals of the research in [51] are to recognize the key causes of construction delays in Saudi Arabian projects, quantify the consequences of construction delays in Saudi Arabia, and provide practical deterrent strategies to remove or reduce project delays. The causes and impacts of delays in the building industry in Saudi Arabia were investigated using a questionnaire. The top five common causes of delays, which occurred from contractor-related causes of delays, were identified as an absence of manpower skill (mean score 4.51 out of 5), manpower shortage (mean score 4.33 out of 5), delays in material delivery (mean score 4.13 out of 5), material shortage (mean score 4.13 out of 5), and poor project planning and coordination. From the literature, fifteen consequences of construction delays were

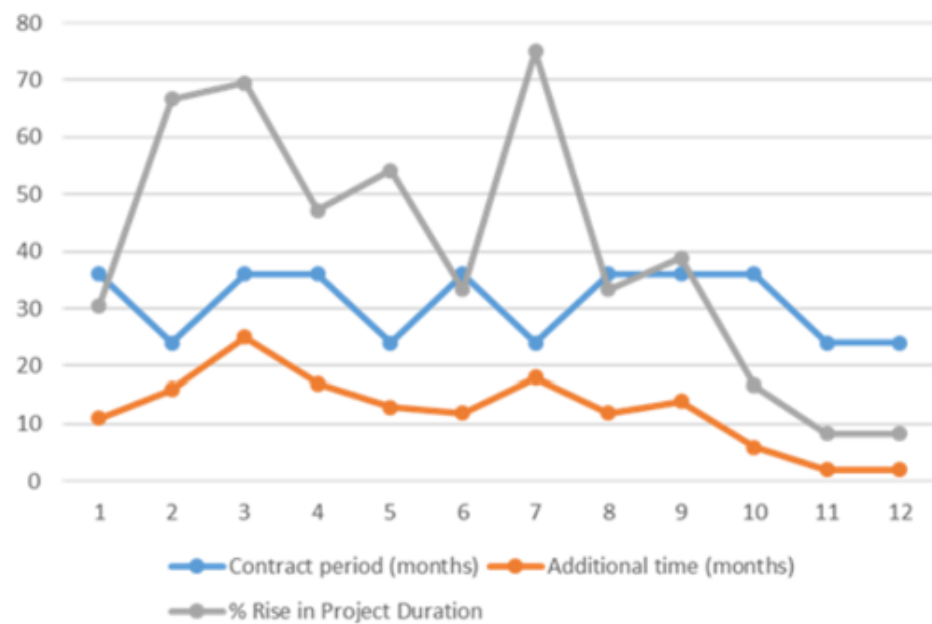
recognized and provided to respondents in a questionnaire. According to the research, the top five effects of construction delays are the deterioration of company image (mean score 4.27 out of 5), bankruptcy (mean score 4.16 out of 5), stress for contractors (mean score 3.56 out of 5), total abandonment (mean score 3.53 out of 5), and acceleration of losses (mean score 3.02 out of 5).

The primary causes of delays in significant building projects in Saudi Arabia are discussed in [52], along with their relative importance. A study of 24 contractors, 15 architectural/engineering firms (A/E), and 9 owners from Saudi Arabia's Eastern Province was conducted. The respondents were asked to rank the relevance of 56 different sources of delay in the poll. Nine significant groups of delay causes were identified. For contractors, owners, and A/Es, the significance of the causes and groups was quantified and ranked using an importance index. The rankings of the individual delay factors were found to be by and large agreed upon by contractors, A/Es, and owners. It was also demonstrated that contractors and A/Es had a good working relationship. It was also discovered that contractors and A/Es agree on the ranking of the delay factor categories, however, contractors and owners, as well as A/Es and owners, disagree. It was also discovered that all three parties placed the financial category of delay reasons highest, while the environment was ranked lowest.

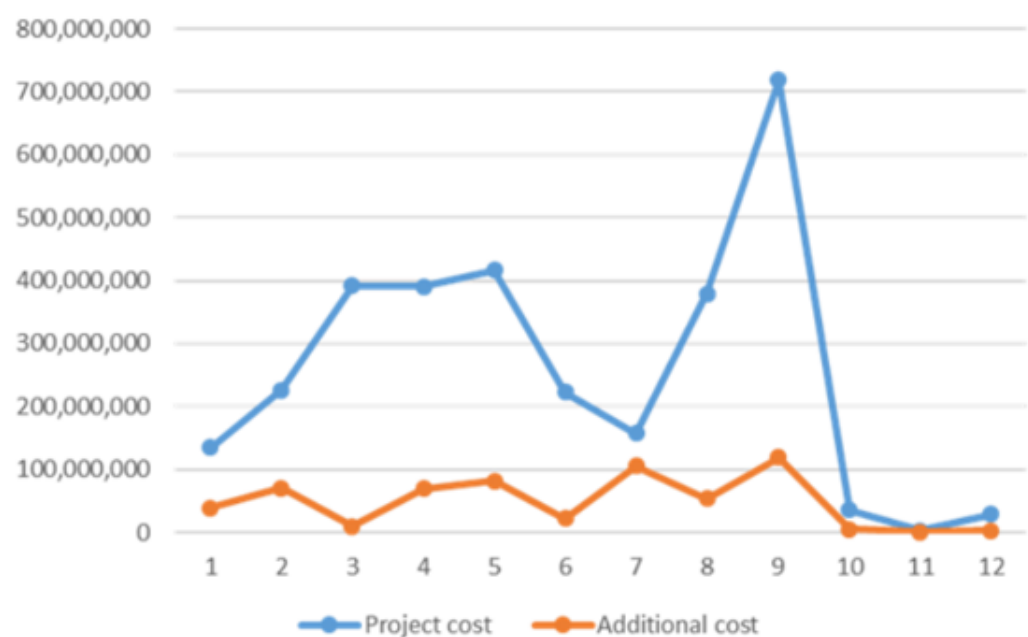
The purpose of the research in [53] was to look into and analyze the summons that building projects confront that cause them to be late. The study focused on construction delay concerns as perceived by contractors. Contractors were given a questionnaire to fill out to analyze the most common construction delay sources in Saudi Arabia, as well as the incidence of delay. Payment delays, project cost underestimation, legal issues, municipality permit obtainment, lack of communication between parties involved, completion time underestimation, instruction delay from owners and consultants, and poor supervision were identified as primary contributors to construction delays using the Relative Importance Index (RII) technique.

Ref. [54] shows the 12 MOH projects were analyzed. The average amount of time added to 12 MOH projects in Saudi Arabia was 40%, according to analysis (Figure 4a), whereas the average amount of money lost due to delays was 20%. (Figure 4b). It was determined that a variety of problems, including a customer payment delay, a change order, delays in accepting it, bad scheduling and planning, and poor communication contributed to the project's greatest delay, which was 75% of the original duration.

Project management success is determined by cost, time, and quality. However, poor performance in construction projects is a global concern, and Saudi Arabia's construction industry is no different. The study in [55] suggests that to complete projects on time, there is a greater need for collaboration among the customer, contractors, and consultants. Through a questionnaire survey, the study in [56] will evaluate the performance of construction projects in Saudi Arabia to determine the causes of subpar performance and how serious they are as reported by public owners, contractors, and consultants. Owner's regard 'poor communication between project participants' as the biggest issue influencing project performance, followed by 'bad labor productivity' and 'poor planning and scheduling,' according to the findings. Contractor input indicates that 'payments delay' is the most serious factor, followed by 'escalation of material prices' and 'poor labor productivity,' respectively. As per consultant input, the top three influencing variables are inadequate planning and scheduling, poor site management, and payment delays. The findings and recommendations of this study could help key project participants and researchers.



(a)



(b)

Figure 4. Increase in (a) duration and (b) cost of the MOH projects [54].

The study in [57] looks into the variables that brought about work delays in one of the most recent significant rebuilding projects in the Middle East, the Mataf Expansion Project in Mecca, Saudi Arabia. It was discovered that one of the primary delaying issues during the reconstruction is the building material. Any developing country's socioeconomic progress is dependent on the construction industry. Construction time acts as a yardstick for evaluating a project's success. The designing and building phases were frequently delayed due to unexpected challenges identified during the conception phase. In Saudi Arabia, a survey was done to establish the specific causes of project delays. This was accomplished by

conducting a critical examination of the literature and gathering responses from consultants, project managers, and engineers involved in construction projects. The relevance of the project owner's involvement, contractor-related issues, financing-related issues, materials-related issues, and design documents-related issues have all been identified as major delays. A comparison of the causes of time and expense overruns was made with previous research. Slowness and lack of limitation were compared to numerous historical types of research done in Asia and Africa, which provided seven delay factors: incompetence, design, market and estimate, financial capabilities, government, and workers [58].

The construction sector, being one of the fastest expanding fields of engineering, provides a platform as well as defiance for engineers to explore new horizons in building construction. The challenge considers the use of technology developments in energy sources while also minimizing all environmental concerns. Construction project postponement is a concern in developing countries, particularly in the Middle East, including Saudi Arabia. A survey was undertaken as part of the study in [59] to pinpoint the causes of delays in the Saudi construction industry. After spending a significant amount of time analyzing all the aspects using statistical analysis, some major reasons such as the owner's late payments, the low level of customer satisfaction, contractor's project planning, sub-standard work, Contractors' lack of dexterity, as well as their qualifications, a weak tendering system, and the role of low bidders were identified.

The top 20 causes of non-excusable construction project delays were discovered using a Delphi questionnaire survey and the Mean Rank approach in [60]. A test of the hypothesis was designed and a substantial level of agreement among the experts was validated to establish whether the panel of experts are in general accord concerning their ranking of the causes of blatant building delays. The most common cause of unavoidable construction delays was "failing to hire competent subcontractors".

Because of the rapidly evolving Saudi building market brought on by increased oil money, to handle the difficulties of managing infrastructure projects, the finest project management techniques must be given priority. In the Saudi construction business, the study creates a framework for recognizing and categorizing project failure causes. A quantitative questionnaire survey was utilized to gather responses from 67 respondents in Jeddah, who were chosen using an online questionnaire survey in [61]. Civil engineers, architects, quantity surveyors, and building engineers were the primary respondents, all of whom have extensive expertise in managing infrastructure projects in Saudi Arabia. Poor risk management was identified as the most crucial failure reason for infrastructure projects, with expense overruns and poor management communication coming in second and third, respectively. In addition, from the 24 items utilized for factor analysis, eight components were recovered. Project management flaws, risk issues, and government meddling are among the identified factors. Project risk management frameworks should be redesigned to instruct clients and other stakeholders on how to reduce unexpected risk exposure in a project, among other recommendations.

The goal of the research in [62] is to recognize key delay reasons that construction practitioners in Mecca City face. Seven research articles on construction delay studies undertaken in various locations in Saudi Arabia yielded a total of 81 delay variables. These parameters were included in a questionnaire that was distributed to construction specialists participating in current Mecca construction projects. The poll was conducted by interviewing 28 experts from the consultant, contractor, and project management industries. For each factor, the data was examined using the Average Index approach, and the factors were sorted according to the index to establish their contribution to the delay. Changes in design documentation, low labor productivity, staffing shortages, contractor financing difficulties, poor contract management, and an unqualified workforce are the top six key causes, according to the findings.

The study in [63] addresses the sources of inconsistencies in large building project design and construction. A questionnaire survey was conducted to obtain details on possible sources of discrepancies in the project design and construction interface to meet the study goals. A total of 27 contractors' responses were evaluated. The findings suggest that the primary reasons for inconsistent project design and construction interface are the involvement of designers as consultants, communication gaps between constructors and designers, inadequate plans and requirements, insufficient working drawing details, poor party coordination, a lack of staff at design businesses, and a designer's ignorance of the equipment and materials that are readily available.

The creation of a PLS-SEM Path Model of delay factors in the Saudi Arabian construction industry, with an emphasis on Mecca City, is presented in [64]. The model was created and tested using Smart PLS v3.0 software and includes 37 factors/manifests divided into seven groups/independent variables, as well as one dependent variable, the construction project delay. The model was thoroughly evaluated in terms of measurement and structural elements, and the results revealed that it met the needed threshold values. This methodology will be able to help Mecca city practitioners pay greater attention to risk assessments for future building delays.

Using a quantitative technique, the research in [65] identifies important delay problems experienced by Makkah's construction industry. An organized survey based on a literature study was tested in a pilot study with a group of construction specialists. A survey of Makkah construction professionals, including contractors, consultants, and project management firms, was performed. The survey received 100 valid replies, which were then utilized to rank the elements using the average index method. The top ten factors contributing to construction delays in Makkah are difficulties faced by the contractor in obtaining financing for projects, poor coordination between parties, a lack of labor, delays in producing design documents, improper planning and scheduling of the project, delays in progress payments, low labor productivity levels, poor communication between parties, an underqualified workforce, and poor contract management.

It is estimated that 70% of public construction projects are behind schedule. At a university campus in northern Saudi Arabia, a case study was conducted to determine the key reasons of project delays. There were snags at the university ranging from 50% to 150%. The University Projects Director and five engineers provided the delay considerations. The University delay variables were then contrasted to delay factors established through a literature study on Saudi construction projects. Both types of research found nine reasons for delays, which were compared. The report also suggests a method for reducing the nine major delays. One construction management system, the Performance Information Procurement System (PIPS), has been documented several times for its capacity to increase project performance and avoid delays, according to a literature review [66].

Construction project delays fluctuate from nation to country and even between different initiatives in the same region. The research in [67] examines the reasons for delays within the Gulf Cooperation Council (GCC). Around prior work in GCC nations, a complete quantitative and qualitative literature assessment was conducted. The literature is used to identify the key causes of delays, which are then used in exploratory interviews with professionals in the field to ascertain the applicability of each component in the context of ongoing projects in the GCC construction industry. The study looked at 176 completed projects to see how much time was lost, and the results showed that delays brought on by owners contributed significantly more than delays caused by contractors and consultants. All the projects analyzed had delays due to planning and scheduling.

For the construction partners, the project's cost performance is frequently a major consideration. Cost overrun is a common issue in the construction business, and it has a negative influence on project triumph in terms of time, cost, quality, and safety. Through a questionnaire survey, the study in [68] has explored cost overrun in Saudi Arabian construction projects to determine the causes of cost overrun and their importance to contractors. A questionnaire study of 43 contractors working on construction projects in

Saudi Arabia's Northern Province was conducted. Literature analysis revealed 34 causes of budget overruns. As per the report, the main cost overrun factors in Saudi Arabian construction projects are a bid award for the lowest price, frequent design modifications, poor planning, a long time between design and implementation, and payment delays.

The goal of the research in [69] is to look into three factors that cause delays in the construction of water and sewage facilities in Saudi Arabia: (1) the frequency of projects being delayed, (2) the magnitude of the delay, and (3) the accountability for the delay are three components. The goal of the study is to provide any clarification on the construction issue delays preventing or better managing them. The survey revealed that many projects were experiencing delays. The contractor categorization grade, but not the location where the project is built, appears to be linked to the occurrence of project delays. The degree of the delay was also discovered to be significant, and it was linked to the initial project time. Contractors believed the owner was primarily accountable, but project owners and consultants allocated the majority of the blame to them.

5. Critical Analysis of Literature Review for the Identification of Causes and Effects of Delays

In this section, previous studies in the field of delays in construction companies have been reviewed to identify the most frequent causes and effects of delays.

A number of studies on industrial and construction projects exist. The report in [70] focuses on Saudi Arabia's industrial/manufacturing developments. The goal of this article is to recognize the key reasons for delays in Saudi Arabian industrial projects. Through a literature review and discussions with Saudi Arabian industry professionals, the main reasons for the delay have been determined. The top five factors that affect how long industrial projects take to complete in Saudi Arabia have been identified as challenges the contractor or manufacturer had in financing the project, late material delivery, late material procurement, a delay in progress payments, and a delay in design document approval. The top five mentioned issues, in order of frequency, are delays in progress payments, difficulties with project financing on the part of the contractor or manufacturer, sluggish decision-making, late supply acquisition, and delays in approving design papers. Construction projects in Saudi Arabia are losing a lot of money, compromising quality, and taking a long time to complete public services. Given the situation, the study in [71] attempts to hand out the debate by laying out the primary causes of public construction project delays in Saudi Arabia, based on the order of significance. A complete literature review was undertaken for this aim, and a construction industry survey was conducted in KSA utilizing questionnaires. As survey data, 98 out of 182 questionnaires were gathered. There were 63 delay factors in the poll, and participants were asked to rank them in order of priority. Owner/client-related factors, contractor-related factors, consultant-related factors, and other factors were divided into four groups. According to the findings of the report, the most crucial elements that cause construction project delays in Saudi Arabia are contractor and owner/client-related factors.

The goal of the study in [72] is to identify the factors that lead to cost overruns in Saudi Arabian road construction projects from the perspective of contractors. The most frequent issues impacting cost overrun in road building projects, according to a risk map comprising 41 factors analyzed in a survey include internal administrative issues, payment delays, poor communication between construction partners, and decision-making delays. The research in [73] examines the main causes of infrastructure project delays in Mecca, Saudi Arabia, and compares them to projects in other parts of the kingdom and the Gulf. Data were collected from 49 of the owner's infrastructure projects and evaluated quantitatively to determine the seriousness and reasons for delays. There were ten risk factors discovered as per the owner's perspective, which were divided into four groups. Infrastructure projects in Mecca were determined to be 39 per cent behind schedule on average. The land acquisition component was discovered to be the most significant cause of delay. This underscores the city's crucial land ownership and purchase challenges. Other problems that cause delays

include the lack of experience of contractors, re-designing, and random subsurface utilities (line services). In comparison to contractors, consultants, and other project stakeholders, it was determined that the bulk of owner delays impacted the project. This finding was consistent with the literature on the Gulf Countries Construction (GCC) Industry.

The research in [74] tries to address road construction project delays in Saudi Arabia. The average ratio of intended Contractual length to the time of completion is 58.24 per cent, ranging from 2 per cent to 172 per cent, according to an analysis of the status reports of 55 road projects undertaken in Saudi Arabia between 2011 and 2015. A questionnaire survey was used to look into the primary causes and impacts of timetable delays in road construction projects. A comprehensive questionnaire survey was completed by 70 road building contractors. The severity, frequency, and importance of the 34 factors discovered were all ranked. According to the findings, incorrect planning, low labor productivity, additional work, lack of experience as a contractor, and rework are the top five contributing factors to schedule delays in road construction projects. The goal of the study in [75] is to recognize the factors that hand out delays in public construction projects in Saudi Arabia from the perspective of the owners. A structured questionnaire survey was completed by 22 public owners of construction projects to do so. A review of the literature yielded 35 factors. Bid awards for the lowest price, poor site management, poor communication and coordination between construction parties, rework delays, and low labor productivity are the leading drivers of delays, according to the findings.

The research in [76] examines the major reasons for infrastructure project delays in Mecca, Saudi Arabia, and compares them to projects in other parts of the kingdom and the Gulf. Data were collected from 49 of the owner's infrastructure projects and objectively examined to determine the causes and severity of delays. There were ten risk factors discovered, which were divided into four groups. In Mecca, the average delay in infrastructure projects was determined to be 39% of the planned project timetables. The land acquisition component was discovered to be the most significant cause of delay. This underscores the city's crucial land ownership and purchase challenges. Other variables that cause delays include the lack of experience of contractors, disorganized subsurface utilities (line services), and re-designing. In comparison to contractors, consultants, and other project stakeholders, it was determined that the bulk of owner delays impacted the project. The goal of the research in [77] is to recognize the most common direct and indirect (micro and macro level) disagreements caused in Saudi Arabian residential construction projects. In this study, the questionnaire method was used. The seriousness of the 29 direct and 32 indirect conflict causes was assessed using a randomly distributed questionnaire technique among 120 contractors. The top five serious direct conflict causes, according to the analysis, are: delay in progress payment by the owner, unrealistic contract terms, change orders, poor quality of finished works, and labor inefficiencies. Inadequate contractor expertise, lack of communication between construction parties, bad project planning and scheduling by contractors, poor estimation practices, and cash problems during construction are the top five serious indirect disagreement causes.

Even though the railway construction business has invested a significant amount of money in improving management and technology, most projects in this industry fail to meet their timelines and budgets. The purpose of the study in [78] was to recognize the major causes causing delays in the building of the Riyadh Metro project in Saudi Arabia. A rigorous literature analysis yielded 36 elements that cause delays, which were subsequently distributed in a survey questionnaire to competent industry professionals. During the data collection process, 105 people were interviewed. The data was then statistically analyzed using a variety of methods, including the frequency modified significance index for delay factor ranking and Spearman's correlation coefficient for the link between two sets of data. The top five main reasons for delays in railway construction projects were determined to be the client decision-making process and changes in control procedures, design errors (including ambiguities and discrepancies of details/specifications), labour skill level, client,

or consultant design changes, and finally problems with permissions/approvals from other stakeholders.

Due to the many challenges, they must overcome, airport projects are very difficult and always expose workers to risks. Because Saudi Arabia is the primary landing place for Muslims on an annual basis, the aviation sector is regarded as essential in Saudi Arabia. As a result, through the General Authority of Civil Aviation, the Saudi government has devoted a large portion of its common budget to this industry (GACA). However, it has been discovered that these projects continue to have major schedule and expense overruns. These repercussions are usually the result of project risks. The purpose of the research in [79] is twofold: First, to identify potential hazards related to Saudi Arabian aviation building projects, and then to evaluate how these risks might affect various GACA projects. Currently, the number of airports in Saudi Arabia has increased and as a result, the number of travelers has increased, as can be seen in Figure 5. There have been critical literature assessments of frequent risks linked with aviation projects. Following that, 13 semi-structured interviews with expert project managers, including clients, contractors, and consultants who worked on GACA projects, were conducted. As a result, 54 new hazards were discovered and divided into three categories: internal, external, and force majeure. The findings confirmed that GACA projects experience time and expense overruns.

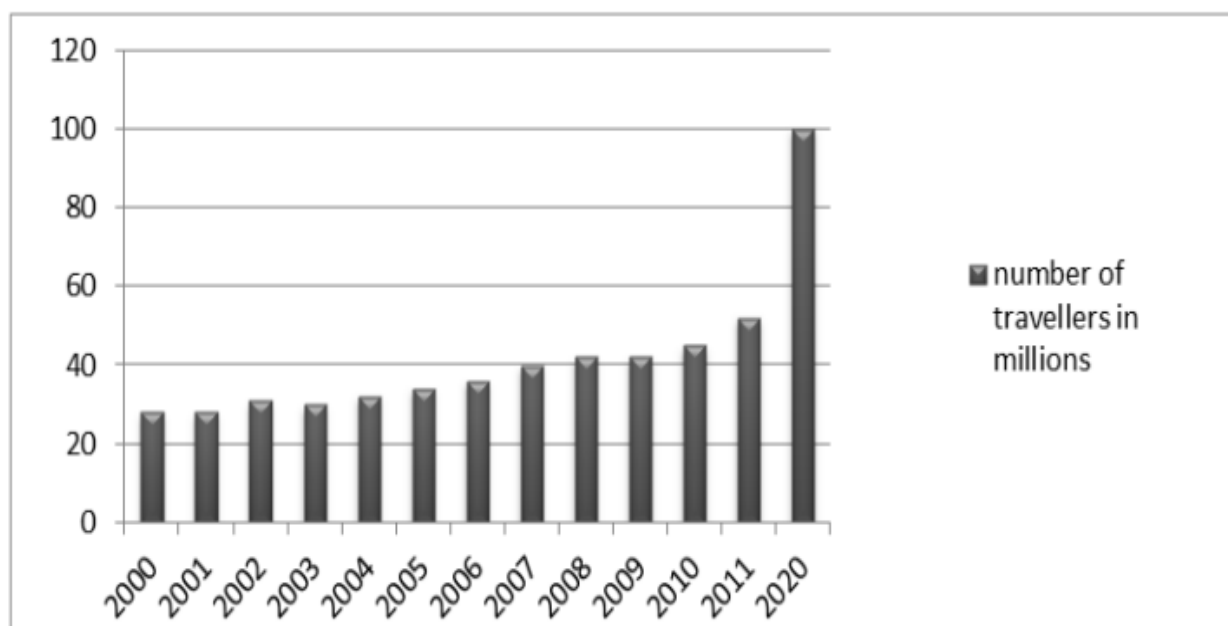


Figure 5. The number of travelers going through Saudi airports [79].

Table 3 illustrates the list of studies conducted to identify major causes of delays in different construction industries in Saudi Arabia.

Table 3. Causes of delay in different construction projects.

Type of Project	Methodology	Causes of Delays Identified	Reference
Industrial/Manufacturing developments	Literature review and discussions with Saudi Arabian industry professionals	Difficulties in project financing, late procurement of materials, late delivery of materials, delay in progress payments, and delay in approving design documents.	[70]
Public construction project	Literature review and questionnaires	Contractor and owner/client-related factors.	[71]
Saudi Arabian road construction projects	A risk map comprising 41 factors was analyzed in a survey	Internal administrative problems, payment delays, poor communication between construction partners, and decision-making delays.	[72]
Infrastructure projects	Quantitative evaluation of data from the questionnaire	The land acquisition component was discovered to be the most significant cause of delay.	[73]
Road construction projects	A questionnaire survey	Incorrect planning, low labour productivity, additional work, lack of contractor experience, and rework.	[74]
Public construction projects	A structured questionnaire survey	Bid award for lowest price, poor site management, poor communication and coordination between construction parties, rework, delays, and low labor productivity.	[75]
Infrastructure projects	An objective examination of data from the questionnaire	Land acquisition component.	[76]
Saudi Arabian residential construction projects	A questionnaire	Delay in progress payment by the owner, unrealistic contract terms, change orders, poor quality of finished works, and labor inefficiencies. Inadequate contractor expertise, lack of communication between construction parties, bad project planning and scheduling by contractors, poor estimation practices, and cash problems during construction.	[77]
Railway construction	Thorough literature analysis and questionnaire	The client decision-making process and changes in control procedures, design errors (including ambiguities and discrepancies of details/specifications), labor skills level, client, or consultant design changes, and finally, issues regarding permissions/approvals from other stakeholders.	[78]
Airport projects	Critical literature assessments	A total of 54 new hazards were discovered and divided into three categories: internal, external, and force majeure.	[79]

In this research, the authors have tried to include construction projects in general from all categories including road construction, public construction, railway construction, and infrastructure construction, thus eliminating the limitations of some previous research where only a specific or a particular type of construction project was considered [71]. In [72], only 98 out of 182 parties responded giving it a response rate of around 53% only. For the identification of causes and effects of delays, the authors have reviewed a vast variety of literature including diverse range of projects thus eliminating the limitations of a poor response rate. In some of the previous research, only the owner's perspective is considered [73]. The authors in this research have also tried to include perspectives of all the parties involved in a construction project thus eliminating limitations such as the inclusion of only one particular party.

6. Causes and Effects of Delays Identified Based on the Literature Review

The main causes and consequences of delays identified have been discussed in the sections below.

6.1. Causes of Delays

Contractors find it frustrating and costly when a building project is delayed. Possible reasons for delays include bad weather, equipment failures, staff shortages, missing or incorrect data, project errors, and conflicts. Although there are some factors beyond your control, such as weather, most construction project delays may be prevented. Based on the above literature review, some major reasons for the delay in construction have been identified. Figure 6 shows the main causes pictorially.

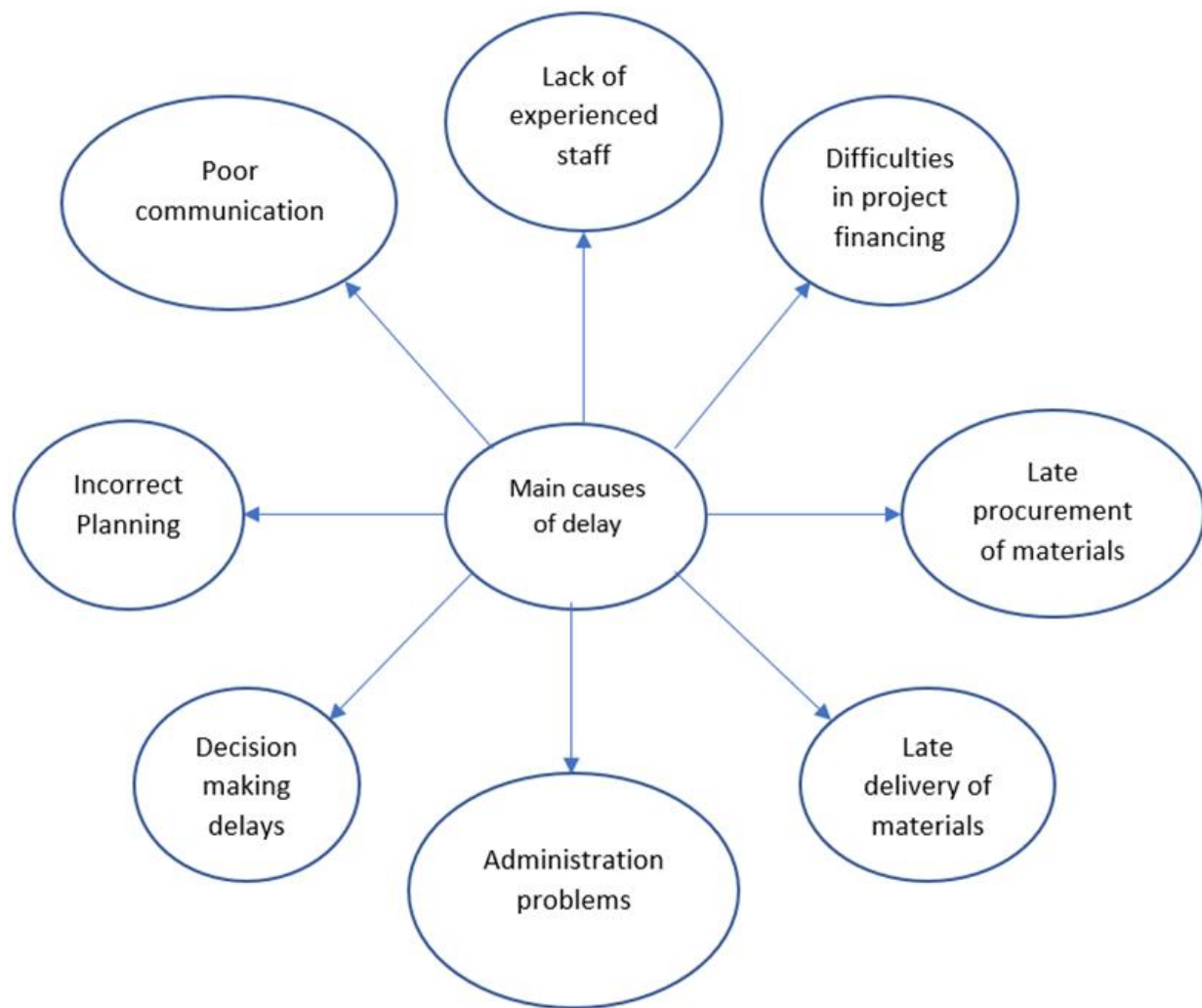


Figure 6. Main causes of delay in the Saudi Arabia construction industry.

6.2. Effects of Delays

Time overrun and cost overrun, which are delay effects in building projects, are the most typical global consequences in the construction industry, according to the literature. Besides these, some of the main effects caused by delays in the construction industry have been presented pictorially in Figure 7.

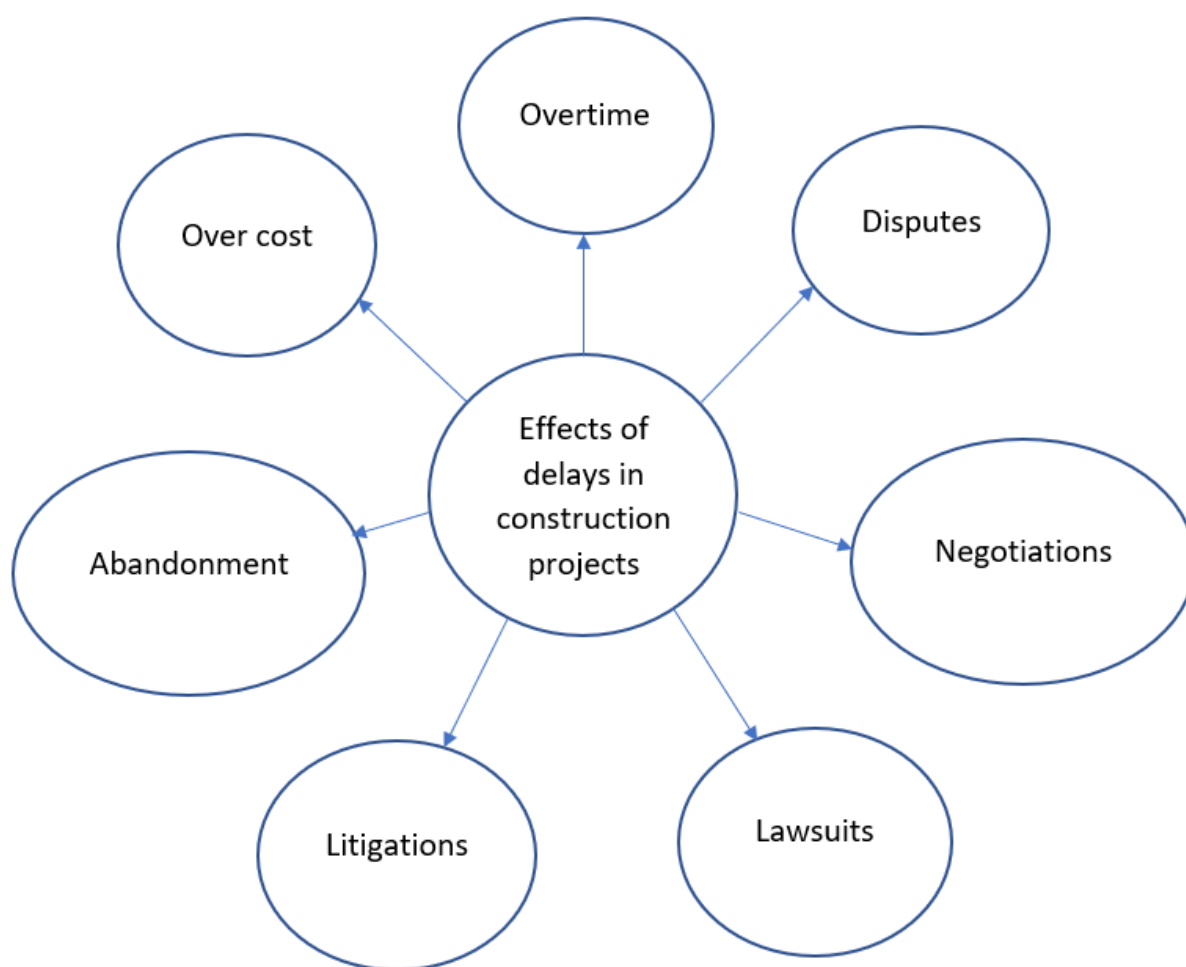


Figure 7. Effect of delays in construction projects.

7. Conclusions

The focus of this paper is to give a general understanding of the construction sector and then provide basic information about the issue of delays faced by construction companies. The confluence of sustainability, efficiency, and innovation for social transformation is at the core of practically all smart city programs. To meet these new demands, construction firms working on the cities of the future are currently undergoing a metamorphosis. The current change in the building industry is dominated by smart infrastructure and architecture. The roads, skyscrapers, transportation infrastructure, and multi-use complexes required in these smart cities are being built by construction corporations. However, just as these cities are fundamentally altering into newly envisaged high-tech connected urban places, so are the specifications needed to build them. All this makes the effective functioning of the construction sector predominant for the development of any smart city. In this paper, the authors have provided a discussion about the factors causing hurdles in the effective functioning of a construction company.

A general overview of construction companies across the world has been provided, but the focus is laid on the construction sector in Saudi Arabia. Various causes and effects of delays have been highlighted based on the literature review. Poor contract management, incorrect planning, lack of experienced staff, decision-making delays, and difficulties in financing are some of the major causes of delays identified. These delays will ultimately cause problems such as over costs, litigation, disputes, and project abandonment. This information can help the people involved in the construction industry because to be able to solve a problem, it is important to identify the root cause of the problem and that is why

identifying the causes of the delays acts as the first step in solving issues related to delays in the construction industry.

To identify all issues that are expected to occur during design and construction, a rigorous approach to project planning is required. Both the client and the contractor must cooperate and make every effort to make allowances for one another. The parties involved need to set attainable objectives for the tasks. The largest aspect in predicting whether the job will be finished on time is probably setting realistic goals. Engineers and architects must determine if a structure is suitable for its intended use and secure (given the estimate). When choosing between subcontractor bids and figuring out if they can turn a profit on a project, contractors use estimates. Having a stockpile of contract examples that cover all potential business processes is essential for effective contract compliance. The materials, guiding principles, steps, etc., required to perform the tasks will be specified in the specifications. Construction drawings provide a graphical representation, indicating the placement of the parts, the level of detail, the dimensions, etc.

It is further expected that the causes identified in this research will be worked upon and ranked based on their severity by conducting various surveys and questionnaires and using data obtained from the surveys to rank the factors. For these, ranking various methods such as “strategic risk severity matrix” and “Severity index ranking” are expected to be used in future.

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